SIX DOLLARS

Electronic Business

FOR MANAGEMENT IN ELECTRONICS COMPUTER & SYSTEMS COMPANIES WORLDWIDE

MAY 29 1989

BEATING THE CLOCK

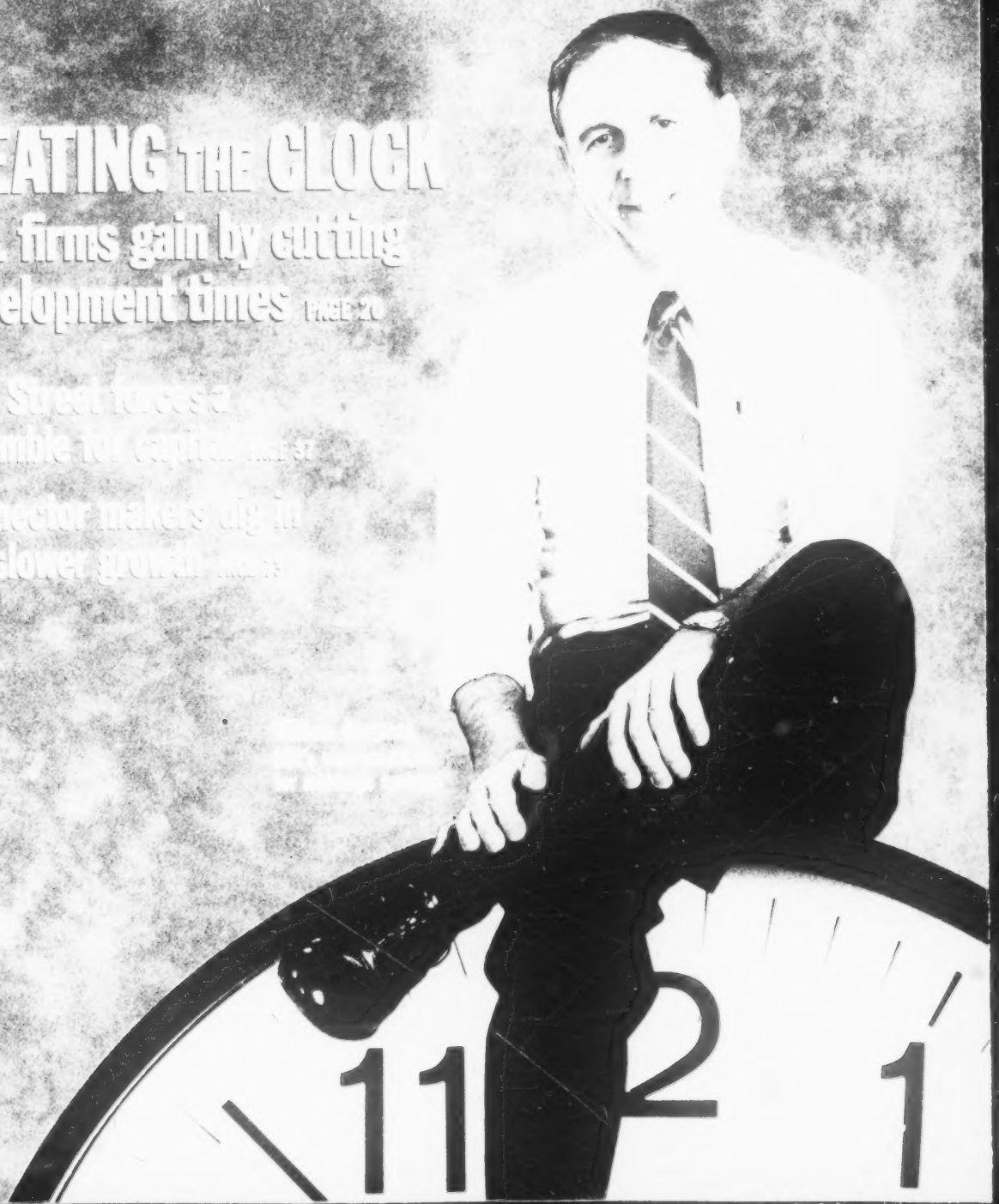
U.S. firms gain by cutting development times

PAGE 20

Wall Street to rescue

scramble for capital

Connector makers dig in for slower growth



Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 15, NO. 11 MAY 29, 1989

PAGE 20 Codex's Jeffrey Walker and DEC's William Demmer: pros at speeding products to market

COVER STORY/STRATEGIES

20 Beating the clock: How to gain from cutting development time

Achieving faster times to market requires the coordination of every corporate division — from product development to manufacturing to marketing. But unwisely overlooked by some companies is the product development function. "Managers must realize that the product development process is not R&D," advises one expert. "It's a business process with business ramifications." Some companies are paying attention with special new product teams, decentralized management and closer links to suppliers.

COVER STORY/STRATEGIES

20 Beating the clock: How to gain from cutting development time

Getting new products to customers faster undoubtedly helps market share and extends life cycles. For many companies the answer to streamlining time-to-market may lie in product development. Some companies are scoring after restructuring their development organizations to hustle products through.

23 Digital's plan that breaks the life-cycle tyranny

Companies often are put in the uneasy position of balancing the advantages of a jump in sales with a new-generation product against the probability of lost sales because of obsolescence of an existing line. Digital's modular system design approach provides a common platform on which successive generations can be built.

25 Codex program halves development times

Codex, faced with shortening communications product life cycles, implemented a three-stage "phase review" process to streamline and coordinate product development.

26 The status of manufacturing is on the rise

Many companies still consider manufacturing to be "one of the evils" that goes with the territory. Yet that might be changing.

28 Reorganize the process, then automate

Design tools, such as CAD/CAE and CASE, automate specific steps in the development process, offering a boost to companies seeking to speed products through.

MANAGING RESOURCES

37 Wall Street forces high tech to scramble for capital

Fast-growing U.S. electronics companies, spurned by Wall Street, are weighing "every imaginable alternative short of bank robbery" to satisfy their insatiable appetite for capital. Some CFOs increasingly are looking to overseas investors. They also are sorting out their options at home and rethinking such traditional issues as debt-versus-equity and public-versus-private financing.

51 Daring to be different in a new world of standards

In this fifth article in a series on winning with competitive engineering, McKinsey & Co.'s Ron Bohlin and Peter Mendelman discuss standardization in the computer industry. While many disagree as to what is and what is not a standard, there is agreement that standards of one kind or another are becoming increasingly influential at all levels of systems architecture.

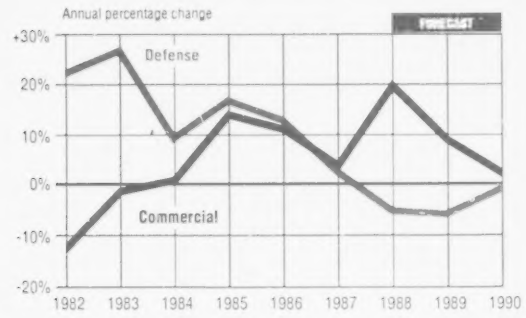
ASIA/PACIFIC BUSINESS

63 MITI report pats Japan's technologists on the back

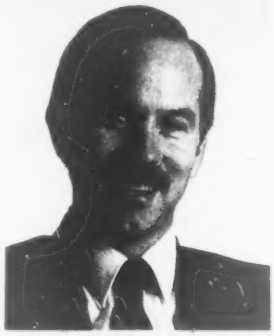
Japan's research establishment thinks Japan has caught up with or surpassed the United States in most key electronics technologies. With little technology left to borrow, MITI figures it will have to start funding Japan's own basic research for the next generation of technology. The first target areas are neural computers, optical computers and high-temperature superconductors.

PAGE 85 AT&T's Bill Gilbert: "The customer won't buy a system without good network management"

PAGE 37 Sun's Austin Mayer: An initial public offering of Sun's Japanese subsidiary is a very real possibility



PAGE 123/124 Consumer and military electronics



PAGE 97 Analogy's Johnson

MARKET PERSPECTIVES

73 Connector makers dig in for slower growth

American companies dominate the $14 billion worldwide connector market, even chalking up a positive world trade surplus of $2.1 billion in 1988. But there is little reason for smugness: continual attrition of vendor lists by OEMs is serving to pressure connector makers to work smarter and more efficiently.

85 Where's the beef in integrated network management systems?

The market for such INMS systems — also known as "manager of managers" or umbrella systems that can meld network managers from different vendors — is small. But vendors say the numbers are misleading as they ignore a broader demand picture. They say future communication systems sales may depend on a vendor's INMS offering.

97 Analog simulation sector will treble in four years

As digital EDA tools mature and become widely accepted, companies that have gained benefits from these devices are attempting to solve the other part of the problem: analog design and simulation. While the market for analog simulation remains small, it is growing rapidly, escalating 45% last year to $67 million.

BUSINESS BAROMETER

123 Consumer electronics

For manufacturers and dealers of video and audio systems, changing demographics mean a bigger and faster growing market.

124 Military electronics

The writing's on the wall. The military spending spree of the Reagan administration has given way to fiscal constraint. Still, defense news will play better for electronics, as upgrading of current weapons systems will remain a priority.

DEPARTMENTS

5 **Inside Business**

9 **Letters**

13 **Upstarts**
CFM Technologies, Network General, Safe Computing Company

106 **Coming Attractions**

115 **My View**
Teachers. Drugs. And despair.

116 **Advertiser index**

128 **Viewpoint**
Prepare to descend on Wall Street

COMPANIES IN THIS ISSUE

106 **An index of the companies covered in this issue.**

EDITORIAL STAFF

Publisher: Frank J. Burge

Editor: John Kerr

Executive Editor: Jeff Bairstow

Managing Editor: Roger C. Plant

Senior Editors: Linda Stallmann (Financial); Anne Knowles; Bruce C. P. Rayner; Valerie Rice

Associate Editors: Barbara N. Berkman; Michael Leibowitz; Rick Whiting

Assistant Editors: Anthony E. Greene; John McCreadie

Section Editor: Marvin V. Greene

Copy Editor: Barbara Jorgensen

Contributing Editors: Elizabeth Baatz (Cahners Economics); Euan Barty (Hong Kong); Dwight Davis (Boston); Madeline Franchi (Cahners Economics); Sarah Glazer (Boston); Shohei Kurita (Tokyo)

Consulting Editors: Alberto Socolovsky; Allen Furst (China)

Production Editor: Linda S. Cohen

Assistant Production Editor: Karen J. Covey

Editorial Assistant: Sherri Hartlen

ART STAFF

Art Director: Bill Cooke

Associate Art Director: Carla Aguilar Leeder

EDITORIAL OFFICES

Boston: Cahners Building
275 Washington Street; Newton, Mass. 02158
(617) 964-3030 Telex: 94-0573 CPC BSN
Fax: (617) 558-4327 MCI: EBBOS

San Jose, Calif.: Valerie Rice; John McCreadie
Sherman Building, 3031 Tisch Way, Suite 100
San Jose, Calif. 95128 (408) 296-0868

Irvine, Calif.: Bruce C. P. Rayner
18818 Teller Avenue, Suite 170
Irvine, Calif. 92715 (714) 851-9422

Northwest: Paula Doe
5011 133rd Place SE
Bellevue, Wash. 98006 (206) 641-0903

PRODUCTION

VP Production: Wayne Hulitzky

Director of Production/Manufacturing: John R. Sanders

Production Supervisor: Andrew A. Jantz

Production Manager: Betsy Harkins; (617) 964-3030

CIRCULATION

Group Circulation Manager: Eric Schmierer
44 Cook Street, Denver, Colo. 80206
(303) 388-4511

Total Circulation: 77804

REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Joanne Westphal, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5080, Des Plaines, Ill. 60018; (312) 635-8800. Electronic Business can be purchased on 35mm microfilm through University Microfilms Int., Periodical Entry Dept., 300 Zeeb Road, Ann Arbor, Mich. 48106.

Quite a production

Reporters usually know little and care less about what happens to their scintillating prose once they hand it in. But there's a wealth of skilled effort that goes into transforming the raw copy into the refinement of a glossy magazine page.

On ELECTRONIC BUSINESS, we're lucky to have the talents of a duo that makes the conversion process look effortless: our production editor, Linda Cohen; and assistant production editor, Karen Covey.

Linda and Karen are superb traffic managers. Somehow, they know where all the copy is for any issue at any time. In fact, they're processing stories in various stages for up to three issues simultaneously.

Theirs is the unenviable pressure-cooker task of keeping things on schedule when one or two stories get off to a slow start. Processing for our production crew doesn't just mean expediting, though; they add value at many stages, be it Linda's creative assignments to photographers for our inside shots or Karen's crisp page layouts. And throughout the production stages, theirs are some of the final calls on quality: everything from the pagination to the correct headlines and colors. If only more reporters were appreciative. . . .

Downing development time

All across the U.S. electronics industry, the topic of cycle time — the period between identification of a customer's need and satisfaction of that need — has been moving up on management's agenda. Much has been made of manufacturing throughput, of JIT and EDI and zero inventory. But less has been said about the benefits of trimming the time it takes to develop a product. In our cover story, contributing editor Dwight Davis lays out a convincing case for why it's essential to be first to get the product off the drawing board.

JOHN KERR, editor

Karen Covey, assistant production editor, and Linda Cohen, production editor

ELECTRONIC BUSINESS (ISSN 0163-6197) is published bi-weekly, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Senior Vice President/General Manager, Boston Division; Jerry D. Neth, Vice President/Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President/Production and Manufacturing. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5800. Telephone (303) 388-4511. Second class postage paid at Denver, CO 80206-5800 and additional mailing offices. POSTMASTER: Send address corrections to ELECTRONIC BUSINESS, at the Denver address. ELECTRONIC BUSINESS® copyright 1989 by Reed Publishing USA. Saul Goldwitz, Chairman; Ronald G. Siegel, President/C.E.O.; Robert L. Krakoff, Executive Vice President; William M. Platt, Senior Vice President. Annual subscription rates for non qualified people: USA/Canada/Mexico: $69.95 per year; other countries: $110 per year (including air freight); $210 per year for air mail. Except for special issues where price changes are indicated, single copies of regular issues are available for $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5800. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Manufacturing • Foodservice & Lodging • Electronics & Computers • Interior Design • Printing • Publishing • Industrial Research & Technology • Health Care • Entertainment. Specialized Consumer Magazines: American Baby • Modern Bride.

BPA ABP

Beating the clock

BY DWIGHT B. DAVIS

Sure, getting new products to customers faster helps market share. But product development is the area that can be streamlined most. Companies that realize this are scoring by restructuring their organizations to hustle products through

Profits. Market share. Margins. Return on investment. Quality. These business variables that electronics and computer manufacturers continually strive to heighten may all come down to a single denominator: time.

Reducing the time from each product's concept to its market delivery is intricately tied to a company's success and is gradually gaining among corporate priorities. The first company to market with any new-generation product inevitably will end up with the greatest market share, the greatest overall profits, and the longest product life cycle.

Achieving faster times to market requires the involvement and coordination of every corporate division — from product development to manufacturing to marketing to order fulfillment. Of these functions, product development represents the area that has received the least corporate attention to date. As such, it offers the greatest potential for streamlining and time reduction. Explains one project management expert: "Management must realize that the product development process is not R&D — it's a business process with business ramifications."

"There has been very little corporate investment in improving the product development process," says Mike McGrath, managing director of the eastern United States and Europe at consultant Pittiglio Rabin Todd & McGrath, Weston, Mass. Russell Fradin, a principal with consultant McKinsey & Co., agrees, noting, "Management invariably underestimates the costs of being late to market."

But the managers who don't underestimate lateness are overhauling their organizations to slash development times. Among the changes are: special new product teams; decentralized management; and closer links to suppliers.

The DRAM semiconductor sector illustrates advantages of being first to market, where each generation of product has seen a different dominant manufacturer, says Jack Beedle, president of In-Stat, a Scottsdale, Ariz., semiconductor market research firm. "Hitachi led the 64K market, NEC the 256K, Toshiba the 1-megabit, and Mitsubishi is the likely winner in the emerging 4-megabit market," he says, "each because they were the first company out with product."

Setting the initial price

In addition, being first out gives a company greater flexibility in setting the product's initial price, thereby boosting early margins above those that follow-on competitors will realize. This was the case in the market for V.32 modems, introduced by Codex Corp. of Canton, Mass., at an initial price of about $3,500, according to Jeffrey Walker, Codex director of marketing. "The price has now dropped to $1,300 [to] $1,400," he says, "but we were able to get the higher profits early."

Even when increased market competition forces prices down, the first out retains the less-apparent advantage of maintaining its margins by way of its ability to cut production costs through a relatively high volume of manufacturing. "Product prices decline over time, but the costs of producing the products drop as the volume increases," points out Bill Miller, president and CEO of hard disk manufacturer Imprimis Technology, Inc., Minnetonka, Minn.

Just as companies can increase their income on the

Dave Bradley

backside of a rapid development process, the shorter process allows them to realize savings on development costs themselves. "This occurs since most high-technology development efforts require a certain 'run rate' of resources," McGrath explains, "and a reduction of delays or increase in accomplishments will shorten development time and reduce the investment required."

The development cost savings are generally not proportional to the reduction in time, McGrath says, but can still be substantial. For example, he estimates, a 45% reduction in development time would mean a typical cost savings of about 25% to 30%. As an added benefit, a somewhat surprising consequence of reduced development times is product quality. "Shorter cycle times demand more emphasis on doing things right the first time," McGrath says, "because you can't afford mistakes further down the line."

Shrinking life cycles

Many companies, despite the clear benefits, have been forced to address the issue of compressing product development because of changing market and technological factors. Foremost among these is the shrinking of product life cycles in virtually every electronics industry sector.

The life cycle for personal computers, for example, has dropped from three to four years over the past few years to about two to three years today, "and it's getting shorter," says Paul Lam, senior consultant in the Electronic Systems Section of consultant Arthur D. Little Inc. of Cambridge, Mass. In the semiconductor industry, meanwhile, life cycles have fallen from four to five years to about three years, he says. In-Stat's Beedle cites even shorter semiconductor life cycles of from a year and a half to two years.

The highly competitive market for workstations is also struggling with shortened product lives, says Mike Schafir, product manager in the workstation division of Sun Microsystems Inc. of Mountain View, Calif. "Competitive companies in this business need new products at least every two years," he says.

Laptop computers in recent years perhaps have shown the most extreme example of short-lived products, having been replaced approximately every 18 months, according to Tom Martin, vice president of the computer business unit at NEC Home Electronics (U.S.A.). "The life cycle might have dropped to as low as 12 months if it weren't for the ability of the reseller channels to absorb that great of a rate of change," he says.

Now, Martin says, laptops may begin to buck the shrinking life cycle trend because many of the desired features — such as hard disk storage up to 100 megabytes and high-contrast screens — have been provided by the earlier generations. Even if the high turnover moderates, however, the incentive to expedite the development process will remain strong, he says, in order to realize the benefits of being first to market.

The incentive to be first out is especially powerful in industry sectors such as the OEM disk drive and semiconductor markets. In these, the "window of opportunity" for manufacturers to lock in customers has been shrinking dramatically. Even if product life cycles are fairly stable — as they have been in hard disk drives — this closing sales window is forcing faster new product development cycles.

"If you were not first to market in years past, there was no great harm done, because your customers would take a year or two to evaluate new products before signing volume contracts," explains Miller at Imprimis. "Now there is less than a one-year period in which all the major OEM contracts are settled."

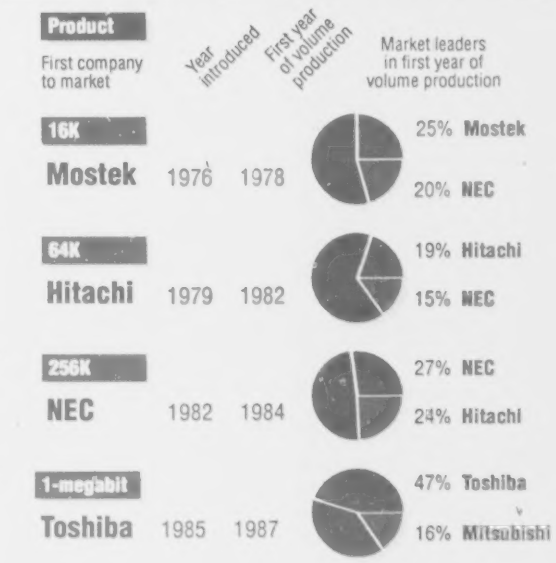
This speed-up has occurred especially with OEMS that sell products with short life cycles such as PCs or workstations, he says. Because their systems' lives are so short, the OEMs evaluate components like disk drives quickly and want volume shipments sooner.

"Before, we would ship a few evaluation units and there would be no volume demand for nine to 12 months," Miller says. "Today, some OEMs want thousands of units within three to six months of the first shipments."

The common, underlying force pressing manufacturers to shorten product life cycles is that of accelerating technological change — particularly in semiconductor technology, which, in turn, stimulates constant change in products based on microchips. "Historically, the inherent rate of change of semiconductors — as measured by circuit density — has been in the 30% to 40% range" annually, says William R. Demmer, vice president of Digital Equipment Corp.'s midrange systems business group, Boxborough, Mass. "The current rate is close to double that."

Demmer points to the time required to move from discrete to integrated implementations of the CPUs in VAX computer systems as evidence of this trend. "Following the

DRAMs: Advantages of being first



Source: In-Stat Inc.

Digital's plan that breaks the life-cycle tyranny

Beating competitors to market undoubtedly is a good strategy, but one some manufacturers consciously choose to avoid. A company's new generation product often will cause the obsolescence of its existing line, leaving a manufacturer balancing the advantages of a jump on the competition against the probability of lost sales in its own backyard.

But if a firm tries to milk its investment in any product line for too long, it may sacrifice future market share. The result has many companies ambivalent about playing the faster-time-to-market game.

Customers, likewise, have reservations about extremely rapid product turnover. While the market overall may eagerly anticipate the next technological innovations, individual customers don't want to find that the electronics equipment that they bought a year or two earlier is antiquated today.

Breaking the cycle

To break from this cycle, some manfacturers are experimenting with new product designs that allow a less-disruptive product path evolution. Digital Equipment Corp. is pursuing such an approach with its VAX 6000 series of midrange computers.

"In the past, each new computer generation was a discrete event," explains William R. Demmer, vice president of Digital's midrange systems business group in Boxborough, Mass. "We would design one computing system, and then would design another completely separate physical system to replace the old."

However, the VAX 6000 series comprises a modular approach to system design, with a common foundation platform upon which successive generations of machines can be built. "The basic physical platform was overdesigned for the initial product so that it can handle future evolutionary change," Demmer says.

The first VAX 6000 series machine, the VAX 6200 systems, contained from one to four processors. Using the same basic platform, the follow-on VAX 6300 — introduced nine months later in 1988 — permits up to six processors, each of which offers 35% more performance than the VAX 6200 CPUs. The maximum six-processor 6300 configuration offers twice the performance of the maximum four-processor 6200.

Similar memory structures

"Meanwhile, we've kept the same memory structure, bus structure, and software compatibility," according to Demmer. This makes it simple for 6200 customers to upgrade their machines to the 6300 level if they so desire.

Digital has encouraged such upgrades with its pricing. Despite its 35% performance advantage over the 6200 line in single-processor configurations, the 6300 is priced at just 5% above the earlier machine. As a result, "We're still marketing the 6200, but not seriously," Demmer says.

Dave Bradley

William R. Demmer, vice president for Digital's midrange systems business group: "We're preserving about 90% of our and our customers' investment in each successive product"

In future iterations, the 6000-series VAXs might provide denser memory capabilities or improve the current I/O bus structure, Demmer speculates. Only when the component evolution reaches the platform's design limitations will a new platform be introduced.

"The life of the system platform might be three to four years," Demmer predicts, "but components like processors might change every year or so."

Because the bulk of the system stays constant during the series evolution, the development of new products is both simplified and shortened. "No engineering design changes are required until we shift to a new platform."

Although the VAX 6300 essentially replaces the VAX 6200, it is possible that not all 6000-series changes will be so evolutionary. "At some point, we may choose to offer more than one product in the line simultaneously," Demmer says.

"We hope to simulate a mindset change both internally and at our customers," he continues. "Because we're preserving about 90% of our and our customers' investment in each successive product, we think we can eliminate the desire to extend the life of products such as the 6200 at the expense of slowing new product introductions."

DWIGHT B. DAVIS

1978 introduction of the first VAX, the VAX-11/780, it took five to six years to move from 'jelly-bean' type semiconductor capabilities to a microprocessor implementation of the CPU," he says.

"At the high end of our 8000-series of VAXs, by contrast, we went from a gate array, discrete logic implementation to a micro version in less than three years," Demmer adds.

A downside to rapid technological change exists: "When technology advances too rapidly there is a time lag between the capabilities of the products and users' ability to apply them," notes ADL consultant Lam. He says it's not clear if, as occurred in laptops, other markets' ability to absorb the new technologies is approaching the saturation point.

In fact, he says, there are some indications that a new-generation product may do well even if its predecessor hasn't been fully utilized. "You might think that the acceptance of the Intel 386 chip would be slow because all of the 286 chip's power has yet to be exploited. But companies are moving quickly to the 386 because it permits them to get a higher price per product."

In coping with the growing imperatives to cut product development times, manufacturers' responses cover the range of doing nothing at all to completely overhauling their development organizations. However, agreement on a key point exists among analysts and those companies working to reduce cycle times: the current processes employed must be evaluated and problems identified before any real benefits can be realized.

Automation can help, but . . .

As a result these analysts and executives say, tools such as computer-aided design, project management, and computer-aided software engineering must be viewed as being of secondary importance. While such tools can significantly improve development times, "if you simply automate your current way of doing things, you may automate the wrong processes," warns PRTM's McGrath.

For manufacturers, the most common development organization — that of assigning tasks by functional responsibility — has proven to be both inefficient and slow, analysts say. Under this approach, each functional task, whether product design, market analysis, or manufacturing, is performed in relative independence.

"Problems arise with the functional orientation because of departmentalization and lack of coordination," says ADL's Lam. Tasks are done sequentially rather than in parallel, groups "sign off" from the project as soon as their job is done, and the entire process lacks cohesiveness, purpose, and accountability.

At many firms, lagging interdepartmental communication stalls manufacturing input early on in the design process. "Because of this, when new products get to manufacturing they often are either not manufacturable to cost or manufacturable at all," Lam says. Thus, many products go through numerous iterations of design and testing, he says, essentially dooming the attainment of faster development goals.

Various approaches do exist to implement more effective development organizations, including Codex's "core team" concept. The objective of these approaches is to group teams around the common activity of shepherding a product from the conceptual stages through manufacturing and distribution. "The greatest gains are achieved by coupling these functions rather than by improving each in isolation," says McKinsey's Fradin.

Simplified decision-making, put in place at Imprimis, is another common element in reorganizing development operations. "In 1985, our hard disk line was badly out of date, especially in the smaller form factors," says Imprimis' Miller. "One of the first things we did was to decentralize from the central management and reduce the length of our decision chain."

New products groups

Some companies —Digital and Sun included — have set up internal organizations devoted to handling new products all the way through pilot production. "Once our New Products Group produces the first 100 to 150 systems, we have a transfer process to move the design into volume manufacturing," says Sun's Schafir. "This way, our volume operation doesn't have to become overly concerned about design issues."

At Digital, a 2-year-old Product Business Unit approach provides a tight coupling among engineering, manufacturing, and marketing activities. It also includes a New Product Start-up function, like Sun's, that moves products through the pilot production stage. Digital's Demmer credits the impressive volume sales of the VAX 6000 series — the fastest selling VAX ever — to the new product operation.

"We were able to prepare geographically dispersed manufacturing

What some other companies are doing to cut their product development times

Sun Microsystems Inc.

Product: Workstations

Action: Set up a new products group to transfer design into volume manufacturing after 100 to 150 systems are produced.

"This way, our volume operation doesn't have to become overly concerned about design issues"

— Mike Schafir, product marketing manager, workstation division

Imprimis Technology Inc.

Product: Hard disk drives

Action: Shortened decision-making process in reorganizing development operations.

"One of first things we did was to decentralize from the central management and reduce the length of our decision chain"

— Bill Miller, president

NEC Home Electronics (U.S.A.)

Product: Laptop computers

Action: Moved its technology center from Japan to San Jose to improve communications with suppliers.

"Improving our physical proximity to our suppliers far outweighed the benefits we could have realized through electronic solutions"

— Tom Martin, vice president for marketing and development

Codex program halves development times

Codex Corp. of Canton, Mass., watched during this decade as the life cycles of its communications products dipped from five to six years to two and a half to three years. At the same time, the Motorola Inc. subsidiary was targeted more and more by the competitive gun of the Japanese — especially in the commodity-like markets for its low-end modems — and Codex struggled to keep pace with rapidly advancing communications technologies at the high end of its multiplexer and network management lines.

Finally, in late 1987, the combination of these factors drove the company to initiate a trial program designed to halve the time required to bring new products to market, says Jeffrey Walker, Codex director of marketing. A year later, the trial program had largely met this goal in three demonstration projects and, this year, it was implemented company wide.

Codex called on the consulting firm of Pittiglio Rabin Todd & McGrath of Weston, Mass., which resulted in the formation of a PACE (Product and Cycle-Time Excellence) team to accomplish necessary organizational changes.

These changes fell into three main categories, according to Mike McGrath, PRTM's managing director of the eastern United States and Europe, the PACE team leader. A "phase review" process was implemented; product development personnel were grouped into core teams, each having a single project manager; and the development process itself was simplified, standardized, and documented. A key goal of the three-stage phase review process was to define the authority and responsibility of both an executive-level Product Approval Committee and the core team itself.

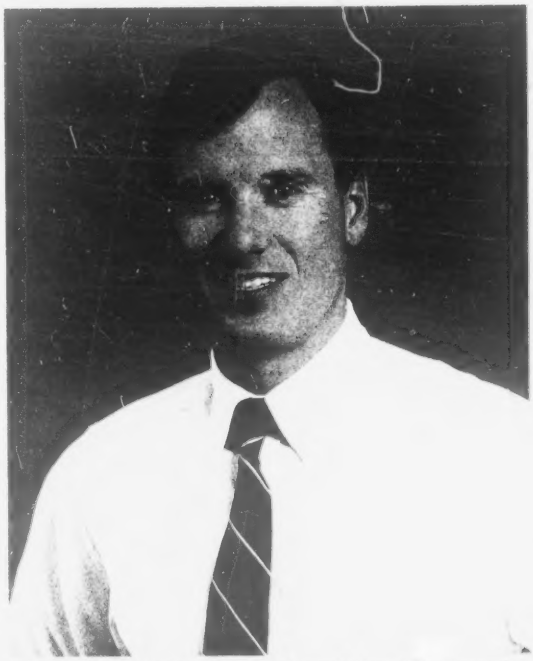
"We needed to eliminate a lot of the unnecessary bureaucratic reviews that are common to all companies," says Walker. McGrath notes that, with the phase review restructuring, "95% of the decision-making authority resides with the core group, and 5% with management in its approval making role."

Evaluation of all functions

The first of the phase reviews occurs after the product specifications and development schedule have been determined. "The major phase review one document is the Summary Product Implementation Plan, which includes everything from the hardware design, to the manufacturing, marketing, and quality requirements," explains Paul Phelan, senior director, total cycle time program.

The second review occurs at the time of the first customer shipment and the start of volume manufacturing. The final phase review follows three to six months later, and evaluates the product's adherence to its schedule and specifications.

Performing the various phase reviews is the product's core team, consisting of a program manager and personnel from all the major functional areas such as marketing, manufacturing, quality assurance, and customer service.



Dave Bradley

Jeffrey Walker, Codex director of marketing: "Because of our more efficient use of development resources it will be easier for us to respond to a wider range of market opportunities and to realize a higher percentage of 'wins' "

"The teaming concept has resulted in better communications and coordination between the different departments," says Phelan, "and accountability is now centralized with the program manager." Along with speeding product development, another expected benefit is higher quality products.

The early results of the PACE-driven changes show reductions of development times from 43% to 50%, with the more complex products realizing slightly greater improvements than simpler ones. Based on composite results achieved so far, the development time for a product of moderate complexity has gone from 145 weeks to 67 weeks, according to Phelan. Such a product would be new to market, as opposed to being an upgrade of an existing device, but would not require any new VLSI development, he says.

Streamlining and coordinating the development process will have benefits beyond shorter times to market, Walker says. "Because of our more efficient use of development resources," he says, "it will be easier for us to respond to a wider range of market opportunities and to realize a higher percentage of 'wins' with our products."

DWIGHT B. DAVIS

Why U.S. firms have to reduce product development time...

- Product life cycles are shrinking
- Development costs are increasing
- Technology is changing rapidly
- Customers are evaluating new products more quickly

...and how are they doing it

- Evaluation of development process
- Tightly coupled new products groups
- Streamlined product designs
- Improved communications with suppliers
- Greater use of design automation tools

facilities to follow a rapid volume ramp up," he says. "On the day [April 1988] we announced the VAX 6200, we began shipping units from our plants in the U.S., Puerto Rico, and Ireland." This volume manufacturing capability put Digital in the happy position of never being supply limited — a familiar problem with earlier lines. When the follow-on VAX 6300 was introduced nine months later, Digital had already done business into the $2 billion range with the 6000 series.

Besides reorganizing and exploiting the power of automation tools to shorten development times, manufacturers also are rethinking the fundamental designs of their products. In semiconductors, for example, "Companies are using ASICs or standard cells to get into the market first," says Zohar Raz, vice president of technology at In-Stat. "Once they've captured market share, they redesign the product to reduce the silicon count."

Another semiconductor design trend is that of reduced instruction set computing (RISC), as opposed to complex instruction set computing (CISC). "Sun developed its RISC-based Sparc architecture for its workstations in part because it is easier to implement than CISC, and helps us get chips faster and debug them sooner," explains Schafir.

Beyond semiconductors, many companies are devoting more attention to determining which product features are critical and which are extraneous. "Nothing will kill a new product faster than putting every bell and whistle on it," says Walker at Codex.

EDI: The link to suppliers

A final area of investigation is electronic data interchange, or EDI. Just as companies must improve their internal lines of communications to speed product development, they also must bolster their links with suppliers to ensure timely component deliveries, and with customers to better gauge and satisfy market demand.

But EDI remains little more than a distant goal for most manufacturers, although "within the *Fortune* 500 companies EDI is being evaluated ag-

The status of long-slighted manufacturing is on the rise

Manufacturing clearly plays a critical role in the drive to place products in customers' hands sooner. Yet, despite the preachings about factory automation, computer-aided manufacturing, and just-in-time processing, most companies still consider manufacturing to be "one of the evils" that goes with the territory, says Anthony Friscia, president of Advanced Manufacturing Research.

"Especially in small electronics industry companies," he says, "manufacturing is the last thing people think about. It is viewed as a cost center, and generally receives management attention only when problems occur."

But fortunately this attitude is no longer universal, and some firms even view manufacturing as the main area to improve time-to-market speeds. "We have already dramatically improved our product development operation," says Bill Miller, president of Imprimis Technology Inc., "and we believe that increasing our production ramp-up capabilities represents the area of the greatest potential gains."

Imprimis is pursuing a multitrack approach, Miller says, with the goal of designing products to match production processes.

For example, if manufacturing engineers don't have a say about a product's design early on in the development process, they may later be asked to produce a product

Improving the materials-handling process can cut idle time

poorly suited to their production facilities.

The need for better internal, as well as external, communications is heightened if a firm attempts to implement a JIT operation, in which inventories of components as well as finished products are reduced or eliminated. Components arriving from suppliers are immediately sent to production lines, and completed products are immediately packaged and shipped.

"JIT involves coordination of a network of suppliers and a tighter linking between the manufacturer and its customers," Friscia notes.

Even without JIT, companies can make great strides toward streamlining their manufacturing processes through relatively simple means, Friscia believes. "On average, raw materials sit around for more than 90% of the time without undergoing any active processing," he notes. By re-laying out a plant and improving the material handling processes, much of this inactivity can be eliminated.

Friscia cautions that manufacturing speed by itself isn't enough of a solution, advising that U.S. firms emulate the Japanese attitude of placing manufacturing on somewhat of a pedestal. "Philosophically, U.S. firms should be building their businesses around their ability to produce quality products," he says. "But most companies here are still more technology driven than manufacturing driven." □

gressively," according to Anthony Friscia, president of Advanced Manufacturing Research. He says some companies such as General Motors Corp., Ford Motor Co. and Boeing Co. are severely limiting the number of suppliers with which they do business, and are then working to establish EDI links among those that remain.

NEC Home Electronics took a different path in improving its communication with suppliers. It shifted its technology center 8,000 miles from Japan to San Jose in order to be closer to the core technologies its laptops use. "Improving our physical proximity to our suppliers far outweighed the benefits we could have realized through electronic solutions," Martin says.

For those companies that succeed in compressing their product development cycle, one remaining benefit exists, according to PRTM's McGrath. "If you have a one-year rather than a two-year cycle, you can better predict the market's needs at the time your product appears," he says.

If the development process takes too long, McGrath continues, the target market's demands may change. "Products that take a long time to reach the market are therefore more susceptible to redesign during the development cycle." And some companies with fast development turnarounds get the luxury of delaying the start of the process, if they so choose. This option, though, is a dangerous one, argues McKinsey's Fradin.

"Often, the issue is less one of how to speed development time than one of how to heighten the organization's ability to start a project early when the opportunity is greatest," he says. "In most cases where market share is lost it is because the company was late in starting its development."

Fradin has dubbed this scenario the "organization paradox." In it — at the time when the opportunity is greatest and before any signs of competition exist — the company's sense of urgency is the lowest, he says.

Therefore, the effort to shorten product development times is linked to beginning as early as possible. "Once the first competitive products appear on the market, the sense of urgency to develop like products is greatest," Fradin says. "Of course, by that time, the opportunity for success has largely passed." □

Reorganize the process, then automate

Although industrial consultants have their differences about how to best achieve faster product development cycles, they all agree on one key point. As stated by Russell Fradin, a principal at McKinsey & Co.: "Mechanical tools to effect faster turnaround times should be applied only after the process itself is revamped."

Companies must first gain an understanding of their institutionalized delays and inefficiencies and move to correct them, Fradin says, otherwise they may be ill prepared for the power of tools such as computer-aided design, project management, and computer-aided engineering. "You don't give a 5-year-old a Ferrari," he cautions.

That caveat aside, automation tools can give a big boost to companies looking to speed product development. "With the simulation techniques of CAD/CAE, we can model everything from the gate level of semiconductors all the way through the system component level," says William R. Demmer, vice president of the midrange systems business group at Digital Equipment Corp.

Automation can boost firms seeking faster development times

Like CAD/CAE, computer-aided software engineering, or CASE, automates specific steps of the development process. CASE is particularly useful, claims Al Connor, vice president of industry marketing at CASE vendor Nastec Corp., because of characteristics peculiar to the software development culture.

"Most software developers didn't start as engineers, and they lack the well defined methodologies of design engineers," he explains. "Software engineering is more of an art form."

The problem with art forms is they are difficult to describe and schedule. "CASE tools provide a standard breakdown and description of the development tasks and give companies a set of guidelines to follow in tracking the work's progress," Connor says.

Some firms see productivity gains as great as 30%, according to Connor, who notes CASE can be cost effective at much lower levels of improvement: "American Express estimates that a productivity gain of just 5% is enough to justify the purchase of CASE tools."

CASE can be especially useful at the front end of the development process, when the manufacturer's software people get together with users to define a product's requirements, says Connor.

If any automation tool has the capacity to closely mirror and assist the overall development process, it is that of project management software. Even vendors of such software caution, however, that it is best to mold the project management product to suit a company's proven process.

"Project management is not intended to solve your development problems," says J. Kevin Fisher, president of project management vendor Productivity Solutions Inc. of Waltham, Mass. "Rather, it helps managers define project goals and use resources in the most efficient means possible."

Fisher notes that in the technology development area, time and resources must be put into balance. However, he notes, many companies simply initiate projects and "hope that things will get done through some serendipitous process. Management has abdicated its responsibility to evaluate and monitor that process."

Project management software can help companies assert tighter process control. It is especially useful when limited resources must be allocated among multiple development projects. "If used properly, project management can help managers understand that the development process can be used as a competitive weapon," Fisher concludes. □

Connector makers dig in for slower growth

The worldwide connector business will grow 5.6% annually through 1993. That likely isn't enough to sustain all of today's players

BY TONY GREENE

Some American companies have come to accept the fact that their days of global dominance in any area are numbered. They've watched as Japan, other Asian countries and Europe have become more effective competitors in the world market.

But there is one electronics sector where this is not even remotely true. The worldwide connector industry is dominated, and looks likely to remain dominated, by U.S. manufacturers. Six of the top 10 worldwide are American. Of the remainder, three are Japanese and one is European. Indeed, U.S. connector manufacturers chalked up a positive world trade surplus of $2.1 billion in 1988, according to connector market research firm Fleck Telesis Inc., of Huntington Beach, Calif.

There is, however, little reason for smugness on the part of U.S. connector vendors. Continual attrition of vendor lists by original equipment manufacturers keeps pressuring connector makers to work smarter and better. Global equipment and materials sourcing is more of an issue than ever. Partnerships with distributors become more crucial. And the push on quality does not let up.

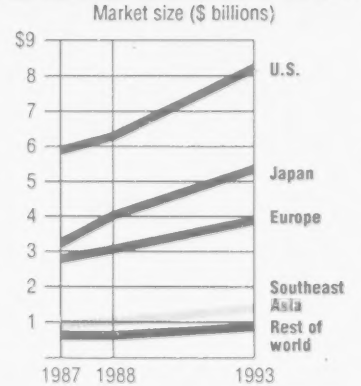
It is estimated that there are between 600 and 800 manufacturers of interconnect devices (connectors, backplanes and cable assemblies) worldwide, competing for a global market of $14 billion; that's up 11.7% over last year. Many of the companies, though, are truly small fry. Eighty-three percent of the market is accounted for by the top 375 companies and over 400 companies have sales revenue of less than $1 million, according to Fleck Telesis. The world market is expected to grow 5.6% annually to reach $18.27 billion by 1993.

Although the market is currently shared by many, the future may hold spots for a substantially smaller number. Connector makers and industry watchers alike see a continuing shakeout in the industry. "I believe there's room for just four or five [major] connector suppliers. A good recession would help us," quips one vendor.

Shakeout is being encouraged by customers that are whittling down their vendor bases as they seek longer term relationships with a few large, financially stable suppliers that can offer the broadest product lines. "When those OEMs come in, they care as much about your financials as they do about your product package," remarks Dominic Pileggi, president of the electronics division of Thomas & Betts Corp., the large Bridgewater, New Jersey-based connector maker.

Another major issue for interconnect makers is technology. "The fact of the matter is, the technology explosion has finally begun to have an impact on interconnection to a substantial degree. For many years, connectors have been static in relation to the electronics revolution. Some companies are in production of connectors that are four generations old," says Kenneth Fleck, president of Fleck Telesis.

Worldwide connector market by region



Source: Fleck Telesis Inc.

New product contributions

That may be changing fast. At No. 2-ranked Amphenol Corp., Wallingford, Conn., president Martin Loeffler cites new product contributions to sales revenue rising from 7% last year to 10% in 1989.

In addition to new connectors, customers also want more interconnect systems. The days of selling connectors and only connectors are fast disappearing. Creating new product is expensive and the financial burden involved will help accelerate the consolidation of the industry.

Possibly the most pervasive issue that will fuel the continuing shakeout is the global nature of the connector industry. Amp Inc., the Harrisburg, Pennsylvania-based industry leader that had $1.87 billion in sales in 1988, has nearly 160 facilities in 26 countries. "The global outlook is the only long-term outlook to be a successful company. We are fully focused on maintaining 15% growth in the future. To do that we have to be a world class global producer," says Amp's president James Marley.

The U.S. market, with $6.152 billion in noncaptive connector sales in 1988, while the largest world market, still comprises only 44% of worldwide sales. Japan, with $3.852 billion, and Europe, with $3.045 billion, combine to account for 48% of the global business. Japan was also the fastest growing world market for con-

nectors, growing 26.7% in 1988 over 1987 sales of $3.042 billion; it is expected to reach $5.13 billion by 1993. "The global nature of the business is critical for those [companies] servicing the 20 to 25 top customers in the world. The top 25 customers make things happen technologically," says Jerry Labowitz, a vice president with Merrill Lynch Capital Markets in New York City.

Serving the customer

The customer is the key to the entire connector industry. When original equipment manufacturers moved offshore, their connector suppliers followed. The competitive nature of the business and the customers' desire to have their vendors where the manufacturing is mandate that connector suppliers be globe-trotters. "You absolutely must be able to service the customers where they live. Our objective is to see all our growth be international," says Marcel P. Joseph, chairman and chief executive officer of Augat Inc., of Mansfield, Mass. "If you don't manufacture you need engineering, sales and warehousing where your customers are," says Labowitz.

There were 22 mergers and acquisitions in the connector industry in 1987 and 27 in 1988

Customers are also driving connector manufacturers to give them more than just a connector. "They don't want to buy just a connector anymore; they want a cable assembly. The trend is toward higher value-added products — subsystems. They want a fuller service product," says Michael Emery, director of the interconnect and packaging group for E.I. du Pont de Nemours & Co., headquartered in Wilmington, Del.

In addition, the technology that is being interconnected is driving connector makers. "Connectors are becoming denser. There are more interconnects and more electrical performance problems. Interconnection is no longer just a mechanical problem. It is also an electrical problem," says market analyst Stephen J. Balog of Shearson Lehman Hutton Inc. This, coupled with the need for subsystems and ever decreasing product life cycles, is driving every major competitor to include an aggressive plan for product development into its strategy.

R&D spending

"Survival will depend on the ability to bring product to market quickly while delivery times go down and quality goes up," says John C. Psaltis, vice president and treasurer of Molex. The push for quality is intense: five years ago parts-per-thousand fail rates were acceptable. Today, fail rates are measured in parts per million, which helps make the quest for new products even more expensive. Amp has spent 9% or more of sales on R&D for the past 30 years: last year, its R&D spending totaled $238 million. R&D budgets that average 5% to 6% of sales are common among the industry leaders.

Much of this money is spent working directly with customers to develop specific applications. Connector manufacturers are striving to produce more proprietary parts as they broaden their product lines. "We will add 30 new connector products to our line this year and 30 more next year," says Augat's Joseph. Approximately 400 of the 694 product lines on the market are commodity products supplied by 15 to 20 manufacturers. These products are highly price-sensitive. This drives companies to try and create proprietary products whose prices erode more slowly.

Another way companies are broad-

1988 top worldwide connector makers

Worldwide sales by region* ($ millions)	U.S.	Japan	Europe	Rest of world
Amp (U.S.)	$1,068	$404	$365	$163
Amphenol (U.S.)	329	30	188	33
ITT Cannon (U.S.)	310	30	234	6
Molex (U.S.)	137	227	83	71
Framatome (France)	117	53	311	24
3M (U.S.)	276	106	87	16
DuPont (U.S.)	224	50	112	70
JAE (Japan)	8	335	6	36
Hirose (Japan)	10	283	3	17
Yazaki (Japan)	43	219	10	10

* Totals do not add due to double counting between regions

Source: Fleck Telesis Inc.

ening their product lines is through mergers and acquisitions. According to a Fleck Telesis report, M&As in the connector industry are occurring at a faster rate than any period since the mid-1960s. There were 22 such deals in 1987 and 27 in 1988.

Pricing pressure has been severe for connector manufacturers in the 1980s. "On a weighted average, six out of eight years in the '80s, connector prices have declined. Only two years have they [connector makers] been able to pass through a price increase. These years have also seen the costs of materials, such as copper, and labor cost rise," observes Fleck. Allan Dickson, director of marketing for Wallingford, Connecticut-based Amphenol, concurs: "Pricing pressures have been quite severe over the last three years, while cost went up. 1989 will see some upward pressure in prices, maybe 5%." Amphenol, with $547 million in sales, was No. 2 in worldwide sales in 1988.

Two industry leaders, Amp and Molex, both pursue another method of customer service that allows them to maintain a proprietary footing for their connectors. Both companies manufacture special application machinery for installing connectors that are leased to their customers. This machinery is usually leased to the customer for use with connectors manufactured by the machine's owner. "Seventy percent to 75% of our product goes through some 55,000 application machines and another 10% goes through hand tools. We have always had a systems approach," says Amp vice chairman Harold A. McInnes. □

U.S. connector vendors in 1988 sell more overseas...

- **38 U.S. firms penetrate the European connector market,** and the U.S. share of the European market reached $1.422 billion.
- **25 U.S. firms market products in Japan,** with the U.S. share of the Japanese market at $948 million.
- **59 U.S. firms distribute products in Canada,** with the U.S. share at $152 million (Canadian).
- **20 U.S. firms market in Southeast Asia,** accounting for $235 million.
- **21 U.S. firms sell in Latin America,** with total shipments amounting to $107 million.
- **The U.S. runs a favorable trade surplus** in connectors, backplanes and cable assemblies of $2.1 billion.

...than others sell into the U.S.

- **108 European firms sell into the U.S. market.** Factory shipments into the U.S. market reached $442 million.
- **38 Japanese firms market products in the U.S.** Factory shipments of Japanese firms increased to $143 million.
- **61 Southeast Asian firms sell into the U.S. market.** Total shipments were $58 million.
- **23 Canadian firms distribute products in the U.S.** Shipments from Canadian firms were $146 million.
- **7 Latin American firms sell into the U.S.,** with shipments of $9 million, while the rest of the world accounts for 11 firms selling into the U.S., and $12 million in shipments.
- **Total foreign share of the U.S. market** increased to $809 million.

Source: Fleck Telesis Inc.

Ad Council

LEARN HOW TO JUMP-START A LIFE.

Learn Red Cross CPR.

American Red Cross

Where's the beef in integrated network management systems?

Vendors have been slow to deliver on promises of INMS packages. Don't they know their future communic[illegible]ns gear sales may depend on it?

BY ANNE KNOWLES

The market is small. The technology's standards are in flux. And the vendors are many. So, who in their right mind would want to take charge of the mishmash network management market? Just AT&T, Digital Equipment Corp., Hewlett-Packard Co. and IBM, for starters.

Each vendor, in the past year, has promised to deliver integrated network management systems (INMS) that do everything from diagnose faults on users' enterprise-wide networks to keeping the networks safe from prying eyes. DEC and HP have established formal corporate programs for it and AT&T has founded an organization to promote an industry standard. IBM, in an unusual move, committed to base future products on that standard. And all are trying to recruit third-party integrators and software firms to help make INMS a reality.

The market for such systems — also known as "manager of managers" or umbrella systems which can meld network managers from different vendors — is small. According to International Data Corp., a market research firm in Framingham, Mass., INMS sales by U.S.-based vendors were $10 million last year and will grow 40% compounded annually until they reach $200 million in 1992. That's a market that third-party integrators could excel in unless the DEC's and HPs get their skates on.

The numbers, say vendors, are misleading in that they ignore a broader demand picture. "People are finally realizing how important the network is," says Bill Gassman, network management marketing manager at DEC's Merrimack, N.H., facility. In turn, network management has become critical. In the future, equipment makers believe, systems sales may depend on a vendor's INMS offering. And that's where the *real* money is. "The customer won't buy a system without good network management," says Bill Gilbert, division manager of network management systems at AT&T in Bridgewater, N.J.

But suppliers of network systems and their subsystems need to be clear about what they want to get out of selling INMS. "Any company that looks at network management for revenue generation is naive," says Kathryn Korostoff, an IDC analyst. "It's for account control."

To date, each piece of equipment that makes up a network — modems, PBXs, multiplexers — has come with its own proprietary network management system designed to manage, monitor and control that equipment. Each network management system (comprising a hardware controller such as a terminal or a PC running network management software) is different from the next; man-

Andrew Eccles

AT&T's network management chief Bill Gilbert: "The customer won't buy a system without good network management"

agement of the network as a whole has been nearly impossible. At best, it has been accomplished manually.

Users' priorities

Users want more than that. According to a survey of the *Fortune* 1,000 by Network Management Perspectives, a San Jose newsletter published by CSI, a division of local area network (LAN) firm 3Com Corp., users' network management priorities are: fault detection/diagnosis, problem management/reporting tools and graphics of network status — all on a centralized network management system.

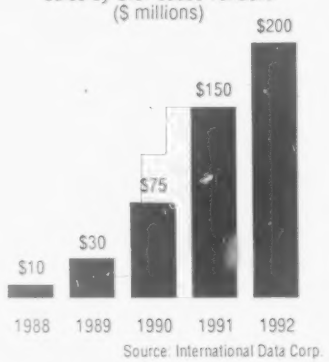
Despite the market's strategic importance, though, "equipment vendors are moving at glacial speeds," says Dixon Doll, chairman, DMW Group, a network integration consultant in Ann Arbor, Mich. Vince Barrett, a principal with Network Strategies Inc., a practice of Ernst & Whinney of Fairfax, Va., agrees: "The problem is, in spite of all the hype and hoopla from the vendors, the meaningful work is still on viewgraphs."

Part of the problem has been standards. The standards for network management — based on the International Standards Organization's (ISO) Open Systems Interconnect (OSI) model — are not completely defined. Designing products based on the early drafts of the standard means vendors will have to keep upgrading systems to remain compliant.

The OSI/Network Management Forum, founded by AT&T and seven other vendors this past summer, was formed to establish implementation specifications, says John Miller, the Forum's president and director of network management market planning at AT&T. (An implementation specification explicitly outlines how to implement a standard to achieve compatibility among products.) So far, the organization, which has grown to about 60 company members, has defined the OSI protocol stack for its users and hopes to vote this month or next on message sets for fault and configuration management, two of the five functions of network management. The other three functions are: performance management, security management and accounting management.

Of the four so-called umbrella vendors, AT&T is the only member of the Forum. Yet each of The Big Four — even IBM — has committed to support OSI. That's because a standard, such as OSI, is the only way network management systems from myriad vendors can be integrated under one umbrella.

Integrated network management systems sales



Equipment makers believe that future communications equipment sales may depend on a vendor's INMS offering

It is difficult to determine exactly what resources vendors are committing to INMS. None of the umbrella vendors will discuss research and development dollars or staff dedicated to it. The systems are not cheap: AT&T's Accumaster Integrator, an INMS announced in February, costs upward of $300,000. Net/Command, an INMS systems announced by third-party Avant-Garde Computing Inc., has an average selling price of $200,000.

Users are demanding INMS packages like the umbrella solutions from AT&T, DEC, HP & IBM

But development is not trivial: Net/Command has evolved over the past two and one-half years while 11 engineers worked on it, says Mahesh Prasad, Avant-Garde's product manager for the system. Net/Command, orginally developed for an IBM microcomputer, now runs on a Sun Microsystems Inc. workstation and uses a database management system from Sybase Inc.

In the past three years, the Mt. Laurel, N.J., network management vendor has spent $10.22 million, or an average of 20% of revenue, on R&D. Excelan Inc., a LAN company recently acquired by fellow LAN vendor Novell Inc., reportedly gave up development of products based on OSI after 20 man-years of development.

IBM's move

So far, only IBM has provided users with a centralized network management scheme. Called NetView and announced in 1986, IBM's system only manages IBM networks. It is also, say observers, a repackaging of existing packages. IBM reportedly has 6,000 NetView licenses out there and about 50 third-party vendors are writing applications for IBM's NetView/PC, the company's interface into non-IBM networks.

AT&T came out with its Unified Network Management Architecture (UNMA) next and plans to ship, by year-end, its Accumaster Integrator. The Integrator allows users to window into various network management schemes through terminal emulation using a Sun workstation. Many market watchers consider it the first INMS system to reach the market. The Integrator is scheduled to ship before year-end and approximately 20 vendors are working on UNMA products to be made available simultaneously.

Both DEC and HP unveiled formal INMS corporate programs last year, called Enterprise Management Architecture (EMA) and OpenView, respectively. But neither have shipped any products based on those architectures. DEC has so far announced that seven third-party vendors are working with the computer maker to interface their network management packages to DEC's VMS-based umbrella system. But DEC cannot disclose when its system, or those of its third-party partners, will be available, says DEC's Gassman. He notes that the company has received over 200 inquiries for interface specifications, but that DEC is cautious.

"There is a lot of pressure to have

"Quality Levels In Mexico Equal To Or Better Than Our U.S. Operations..."

Say U.S. firms operating "maquiladoras" in Mexico!

"The quality levels that we've been able to achieve in Mexico are equal to or better than the quality levels that we've achieved in the United States."

CHUCK PETERSON, General Manager of Nortronics' (magnetic recording heads) maquila operation in Sonora, Mexico.

"Xerox has achieved extremely high levels of quality in Mexico; higher than Xerox probably ever expected. This has been backed up by our low field return rate. And while we did all of this, we've also maintained productivity exceeding 95%."

KEN LILLEY, Manager of Xerox' Office Supplies Plant in Sonora, Mexico.

More than 1,500 firms manufacture in Mexico under the maquiladora program and are saving up to $25,000 per direct labor employee per year! Our Maquila Access Services program offers:

THREE PROVEN WAYS

to start manufacturing under the "maquiladora" program:

1 **Subcontract a portion of your manufacturing** to an American firm already operating in Mexico. You get low labor rates and can test/prove Mexican workmanship.

2 **Operate your own production facility** in Mexico under our Original Shelter Plan, the first, most experienced and most complete. You provide product, tools and a manager – WE PROVIDE ALL THE REST!

3 **Use our turnkey service.** We build and staff a complete, ready to operate facility – your subsidiary in Mexico. We take the complexities out of setting up a plant in a foreign country.

These production options are available in the Mexican states of Sonora and Baja California. Let us help you take your first step into Mexico as we've helped more than 50 major American manufacturers including Xerox and Nortronics. For information on manufacturing in Mexico contact: **Rudy A. Piña,** Director of Marketing.

COLLECTRON OF ARIZONA, INC.
3000 Mariposa Road • Nogales, AZ 85621
(602) 287-6209 / 287-6695

it tomorrow," states Gassman. "But we're going to do it right. No product before its time."

HP has announced five similar third-party agreements and has promised to port its system, which currently runs on an HP Vectra personal computer under MS/DOS, to Unix. HP is currently shipping systems that manage its own equipment, says Dave Mahler, HP's product marketing manager for network management in Cupertino, Calif., but the computer maker plans to have interfaces to systems from LAN maker Ungermann-Bass Inc. and other vendors' equipment that HP cannot yet disclose.

Most of the third parties are communications equipment vendors that have substantial installed bases of existing network management systems. Modem maker Codex Corp., for example, is one of seven third parties developing interfaces for DEC's

The U.S. INMS market will grow about 40% annually until it hits $220 million in 1992

EMA. Racal-Milgo Inc. is currently working on an interface to AT&T's Accumaster Integrator that the modem maker plans to ship by the end of the year, says Bill Vasquez, Racal-Milgo's product manager for integrated newtork management systems. General DataComm Industries Inc. is currently integrating its three network management products under one system called Megaview. Then, the company will bring out an interface to IBM's NetView, AT&T's UNMA and DEC's EMA.

Some third parties, such as Avant-Garde, are offering INMS on their own. Others — consultants and systems integrators such as Andersen Consulting, Boeing Computer Services Co. and Computer Sciences Corp. — are providing customized INMS services which only the largest users can afford.

But that may change once the large vendors get their act together. "Niches are difficult to defend," says NSI's Barrett. "Once the major vendors address the market, the niches may go away." □

Analog simulation sector will treble in four years

Affordable compute power and higher efficiencies in digital design will help drive the worldwide market to $378 million in 1993

BY TONY GREENE

As digital electronic design automation [EDA] tools mature and become widely accepted, companies that have gained the benefits of these tools are attempting to solve the other part of the problem: analog design and simulation.

Given that much of the physical world is analog, there is a real need for analog design tools and, in particular, analog simulation software. Helping meet that need are the availabilty of more powerful, affordable workstations and the rapid increase of the analog component of printed circuit boards and integrated circuits.

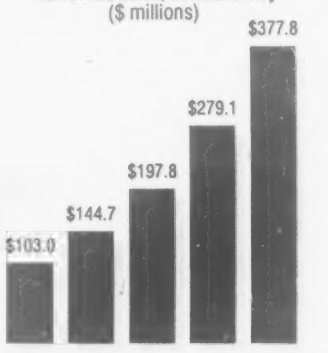
Although the market for analog simulation is still not large, compared with the digital simulation market, it is growing rapidly. The worldwide market escalated 45% in one year to $67 million in 1988. It is expected to grow to $103 million in 1989 and reach $377.8 million in 1993, according to the Technology Research Group, a Boston-based market research firm. "We are seeing the rapid emergence of a technology that is finally ready for the market. Analog simulation technology, up until now, has been used by only those who really needed it. What is going on is very much like what happened to digital simulation three or four years ago," says TRG's president Andrew Rappaport. With $81 million in sales revenue in 1984, the worldwide digital simulation market has since more than tripled, with sales up to a projected $290 million this year.

The major player in 1988, Analog Design Tools Inc. of Sunnyvale, Calif., had sales of $16 million in 1988. [ADT is now owned by EDA industry leader Valid Logic Systems Inc. of San Jose.] Other major players include EDA giants Daisy Systems Corp. of Mountain View, Calif., (now Daisy/Cadnetix); Mentor Graphics Corp., of Beaverton, Ore.; and microwave analog tool specialist Electronic Engineering Software Inc., based in Santa Clara, Calif. Each had sales of between $8 million and $10 million in analog simulation in 1988.

"The whole world is analog. You can pretend it is digital until you run into effects that are analog. The biggest driver for the analog market is people wanting to do larger and larger portions of their circuits analog and build larger systems," says Paul Tuinenga, executive vice president of MicroSim Corp., an Irvine, California-based vendor of analog simulation software. Because most systems have to function in the real world, almost all of them have some analog content. A report by TRG estimates that 15% of electronic designs contain at least 90% analog circuitry. This is one extreme, while at the other end of the scale, 34% of electronic designs contain 10% or less analog content. The majority of designs fall in between these two extremes, with a mix of analog and digital.

Analog simulation market

Worldwide sales, software only ($ millions)



Source: The Technology Research Group Inc.

The complexity of analog simulation has kept the market technology driven. So, even though industry leaders such as Valid have been doing analog tools for more than five years, the R&D component of the business is still high. Valid's general manager for its CAE division, Curtis Hare, says the company puts a little more than 22% of analog sales into R&D and 35% of analog sales into marketing and customer support. Marketing and customer support, which have traditionally not been heavy expense areas, are becoming costlier to analog tool companies. The one industry newcomer, Beaverton, Oregon-based Analogy Inc., is planning to allocate 30% of sales to R&D and 30% to marketing.

Where analog is needed

The companies that require analog simulation tools most acutely are in the military/aerospace, automotive and IC industries, according to Analogy's vice president for sales and marketing R. Douglas Johnson. In particular, the military/aerospace companies have a mandate from the government to simulate all designs in an attempt to increase reliability and quality and lower cost.

Automotive companies have seen the electronics content of cars climb steadily as electronic systems are being used in everything from windshield wipers to fuel systems and antilock braking systems.

IC designers are finding that their digital design tools do such a good job of utilizing IC real estate that they have more room for analog circuitry on chips. "Primarily, the pervasiveness of analog circuitry in electronics is driving the market," says

David Burow, vice president for the Palo Alto, California-based analog division of Daisy/Cadnetix (Dazix).

"As things get smaller and faster you need to be concerned with analog properties. With today's digital design tools you can design systems that logically should work but physically won't work," says Johnson. The increased efficiency of digital has also decimated design time. This efficiency coupled with ever-increasing time-to-market pressure is driving the need for simulation. "The importance of analog analysis is increasing as time-to-production that used to be years, is now months. The designs are more complex," says Rappaport. This increased efficiency in digital design is making analog design a focus point for EDA companies. They are now going to be judged, by customers, on how well they handle analog.

Another major driver for the analog simulation market is the constantly improving price performance ratio of engineering workstations. "Affordable compute horsepower is driving the analog simulation market. An engineer can put a workstation on his desk and get real-time simulation," says Ron Collett, senior analyst at Dataquest Inc. in San Jose. One of the drawbacks to analog simulation in the past was the amount of memory and compute power it consumed. It was not unusual to feed analog simulation data into a mainframe computer and wait days for the results.

Modeling technology is one way analog simulation vendors are trying to differentiate themselves

"Computer science is the driving force behind analog simulation. With 8 megabytes [of memory] a digital designer can simulate anything, while with 64MB [of memory], an analog designer can only do 2%," remarks Rappaport. "Raw MIPS are important," says Valid's Hare. One MIPS cost $20,000 in 1982, but is priced at only $850 today, according to International Data Corp. analyst Vicki Brown.

The library issue

As the market grows and the stakes increase, companies in the analog simulation market are striving to differentiate themselves. One method they are using is modeling technology. An analog simulator is only as good as the models it is using. Accordingly, an analog simulator is only as good as its model library. "Libraries are the big issue: the more, the better. No matter how large the library, you are not going to have most of what he [the engineer] needs," says MicroSim's Tuinenga.

Even though the largest library may not have everything the engineer needs, he still wants it. All of the in-

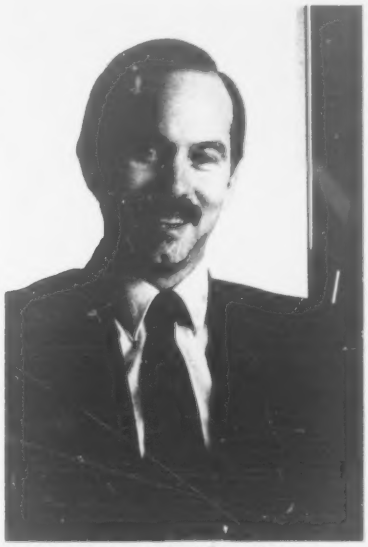
This is how others see LCDs.

dustry leaders have libraries of at least 1,800 parts. Valid plans to have 2,500 with its next release and 3,000 by year-end. "Libraries cost the user as much as, or more than, the user interface. This is reflective of the amount of investment we have to make to the library and the importance of the library to the customer. Modeling is going to be a battle ground," according to Daisy/Cadnetix's Burow, who adds, "I kept both modeling labs open through the merger."

EDA market leader Mentor Graphics lets customers request the models they want. Mentor will then generate and certify the model and make it available to other customers.

The software question

The other battle in analog simulation is the fight between software packages: Sabre, Analogy's product, and Spice. Spice, the public domain analog simulation software developed at the University of California at Berkeley in the mid-1970s, is the current industry standard. The problem with Spice is that it was initially geared toward analog problems in integrated circuits. Analogy claims that Sabre can do what Spice does as well as higher level behavioral models not possible with Spice. "They're really addressing two different customer needs," says Burow. Analogy has OEM agreements for Sabre with companies such as Daisy and Valid, which use the two products for different applications. Sabre is good for looking at entire systems, while Spice excels at the chip level. Rappaport comments, "Sabre is not for the IC guy. It is for the guy doing a control system."



Kristen Finnegan

Analogy vice president for sales and marketing R. Douglas Johnson: Military/aerospace, IC and auto companies need analog simulation the most

Future: mixed analog digital

The future of analog simulation is going to be shaped by the fact that, in five years, most simulators will be mixed analog digital. Marketing agreements and strategic alliances between companies doing digital and analog simulation are appearing at an increasing rate.

This is how HITACHI sees LCDs.

Today's LCD world is moving from monochrome to color. Hitachi innovation and world leadership continue with exciting new *color LCD* technology: our brilliant new *TFT Flat Panel Color Display* offers breathtaking clarity, sharpness and vibrant color saturation that must be seen to be believed. Or choose the new *color DSTN LCD* for more cost-sensitive applications.

The future of LCD technology? It's perfectly clear. It's Hitachi.

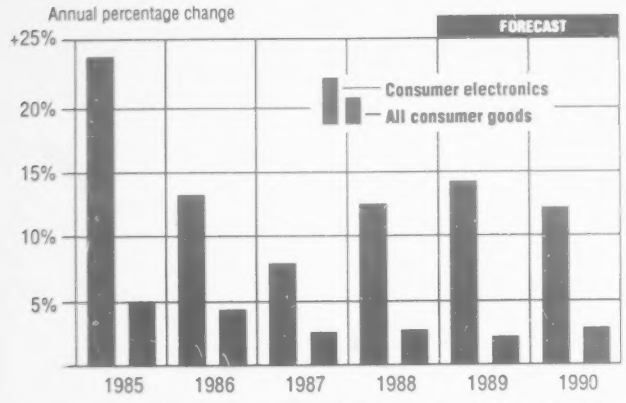
For more information about exciting new Hitachi color and monochrome LCDs, call or write today.

HITACHI

Clearly, Your Best LCD Solution.

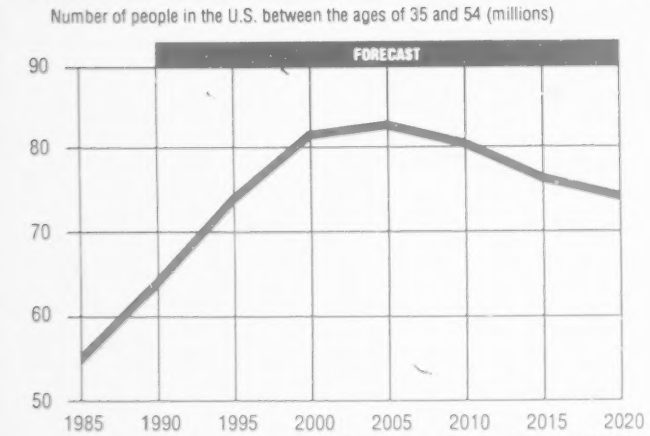
Hitachi America, Ltd.
Electron Tube Division
500 N. Martingale Road, Suite 600
Schaumburg, IL 60173
1-312-517-1144

Consumer electronics outrace total spending



Data source: U.S. Commerce Department; Forecast: Cahners Economics

Population of "peak earning year" consumers



Data and forecast source: U.S. Census Bureau

Sales of home video products

Unit sales to dealers (thousands)	Total 1988 unit sales	Annual percentage change		
		1987	1988	1989*
Color TVs	20,216	+6.2%	+4.6%	+9.4%
Color TVs with stereo	5,090	+40.0%	+17.0%	+13.0%
Black and white TVs	2,580	-9.8%	-27.7%	-28.8%
Projection TVs	302	-3.7%	+3.0%	+5.0%
Home VCRs	12,792	+1.0%	-3.9%	-2.7%

* Forecast

Data source: Electronic Industries Association; Forecast: Cahners Economics

Sales to wealthy support the consumer market

One of the best demographic trends for consumer electronics since the baby boom is in the making. For manufacturers and dealers of video and audio systems, the changing demographics mean a bigger and faster growing market. America's wealthy will be buying more expensive and more sophisticated consumer electronics products.

Over a person's work life, paychecks are fattest between the ages of 35 and 54. Those are the so-called "peak earning years" that marketers love to target. Fact: Between now and the year 2006, over 23 million more people are going to be celebrating birthdays during their peak earning years.

With all those wealthy, middle-aged consumers coming home from work, the next 15 years will be bonus years for makers of high-tech, expensive home electronics. This market of 35 to 54 year olds will be at its biggest, around 83 million people, according to the U.S. Census Bureau, just six years after the start of the next decade. And by the year 2020, over 74 million people will still be in their peak earning years.

The rich are different

For those selling the newest, most expensive, perhaps most frivolous consumer electronics, the wealthiest of the wealthy remain a critical target market. In 1987, the U.S. Census Bureau counted 5.7 million households whose income totaled $75,000 or more. It's these nearly 6 million homes where the projection TVs, future high-definition TVs and other state-of-the-art home equipment will be residing.

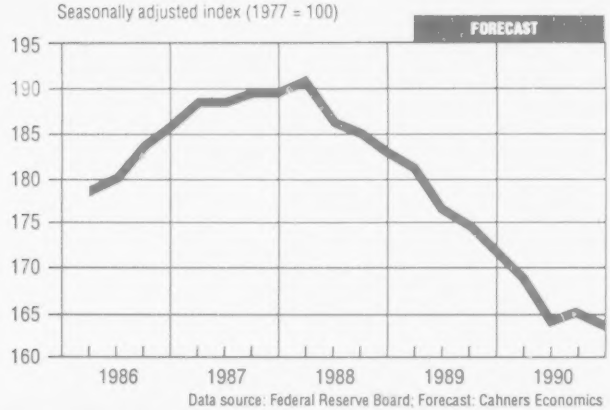
Who and where are America's wealthiest? Most live in or near the city. Over 90% live inside metropolitan areas and nearly two-thirds live in metro areas of more than 1 million people. Most (89%) of these wealthy households are headed by a man and most (80%) are headed by a married man. Four-fifths of them had some college experience and three-fifths completed four years or more of college.

With all these wealthy households, consumer electronics will remain a strong growth market for the electronics industry. For makers of components, these trends are not to be ignored either — the average color TV required 383 capacitors last year.

ELIZABETH BAATZ

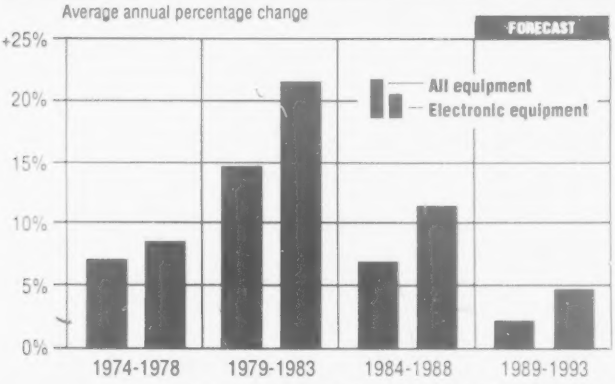
Note: Consumer electronics is scheduled to appear again in the October 30th issue.

Defense & space equipment — Industrial production



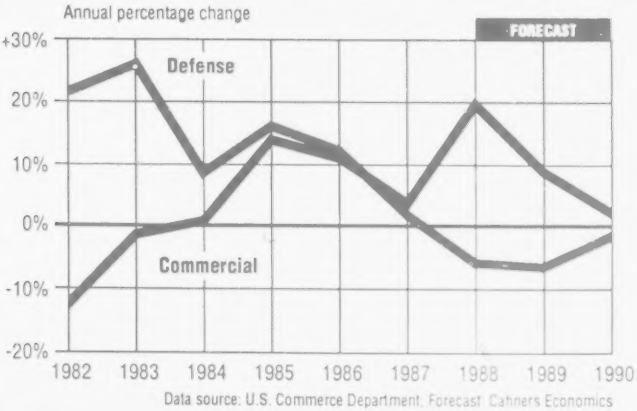
Data source: Federal Reserve Board; Forecast: Cahners Economics

National defense purchases



Data source: U.S. Commerce Department; Forecast: Cahners Economics

Defense versus commercial aircraft shipments



Data source: U.S. Commerce Department; Forecast: Cahners Economics

Military electronics firms adjust to smaller budgets

The writing's on the wall. Military electronics makers are adjusting to tighter budgets as the federal government makes clear its intention to hold interest rates down by cutting the budget deficit. The military spending spree of the Reagan administration has given way to fiscal constraint.

Defense and space equipment output fell 4.9% during the first quarter of 1989 compared with the year-ago quarter. This decline is quite in contrast with the mid-1980s when U.S. factory output of defense and space hardware routinely grew between 8% to 10% per year.

While falling output will be typical of the next few years, the industry has had a lot of time to prepare. Unlike markets where economic trends take an immediate, and often surprising toll, the defense electronics industry growth projections tend to be easily identifiable in the near term. That's because budgets, obligations and procurement take time to work their way through the system. From a forecaster's point of view, government's red tape makes accurate market projections easy.

Silver linings in a cloudy outlook

For electronics makers which have routinely supplied the military market in the past, the next few years will indeed be tough. Marginal firms will be weeded out. Still, the defense news will play better for electronics than any other supplier. Modernization and upgrading of current weapons systems will continue to remain a priority. The result: A higher electronics content will help boost demand for military electronics.

Demographic trends point in electronics' favor as well. The number of young people of recruitment age will be low over the next 10 to 15 years. With fewer soldiers available and with military readiness still a priority, defense department planning will require automation to enhance productivity.

Optimism aside, the military marketplace won't be the best growth market anymore. Take a look at shipments of aircraft. Defense aircraft shipments growth will be heading for a nose dive while commercial aircraft flies high.

ELIZABETH BAATZ

Military electronics is scheduled to appear again in the October 30th issue.